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In re Application of:

Corisis et al.

Serial No.: 09/864,698

Filed: May 23, 2001

For: LEAD FRAME ASSEMBLIES WITH
VOLTAGE REFERENCE PLANE AND IC
PACKAGES INCLUDING SAME

Examiner: D. Graybill

Group Art Unit: 2814

Attorney Docket No.: 3070.2US
(96-1079.2)

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AMENDMENT

Box Non Fee Amendment
Commissioner for Patents
Washington, D.C. 20231

Sir:

The following amendments and remarks are filed in response to the Examiner's remarks in the Office Action mailed December 14, 2001, the three-month shortened statutory period for response to which expires on March 14, 2002.

IN THE CLAIMS:

Claims 1 and 18 have been amended herein. Please note that all claims currently pending and under consideration in the referenced application are shown below, in clean form, for clarity. Please enter these claims as amended. Also attached is a version with markings to show changes made to the claims.

- subcl*
- B'*
1. (Twice Amended) A semiconductor die assembly comprising:
a semiconductor die having a plurality of bond pads on an active surface thereof;
a lead frame having at least a first group of lead fingers and a second group of lead fingers to respectively extend from first and second opposing sides of said semiconductor die attached to a die-attach location on said lead frame to another, single side of said lead frame in a substantially mutually parallel configuration;
a first voltage reference plane to overlie in immediate proximity to therefrom, said first voltage reference plane overlying at least a turning portion of said first group of lead fingers extending from said first side of said intended die-attach location toward said another, single side of said lead frame; and
a second voltage reference plane to overlie in immediate proximity to said second group of lead fingers and in electrical isolation therefrom, said second voltage reference plane overlying at least a turning portion of said second group of lead fingers extending from said second opposing side of said intended die-attach location toward said another, single side of said lead frame. said first group of lead fingers and in electrical isolation
 2. The assembly of claim 1, wherein said lead frame comprises a vertical surface mount package configuration.

- B'
3. (Previously Amended) The assembly of claim 1, wherein said first voltage reference plane and said second voltage reference plane are adhered to at least some of the lead fingers of said first group of lead fingers and said second group of lead fingers, respectively.
 4. (Previously Amended) The assembly of claim 3, wherein said first voltage reference plane and said second voltage reference plane are adhered directly via a non-conductive adhesive to said at least some of the lead fingers of said first group of lead fingers and said second group of lead fingers, respectively.
 5. The assembly of claim 1, further comprising a packaging material encapsulating at least said active surface of said semiconductor die.
 6. (Previously Amended) The assembly of claim 5, wherein said packaging material at least partially covers said first and said second voltage reference planes and said first and said second groups of lead fingers.
 7. The assembly of claim 1, wherein said lead frame includes a die-attach paddle to which said semiconductor die is attached.
 8. The assembly of claim 1, wherein said die-attach location comprises a die-attach paddle.
 9. (Previously Amended) The assembly of claim 1, wherein said first voltage reference plane and said second voltage reference plane are electrically connected to at least one lead finger of said first group of lead fingers and said second group of lead fingers, respectively, which in turn is connected through a bond pad to a reference potential of said semiconductor die.

10. The assembly of claim 1, wherein at least one of said first voltage reference plane and said second voltage reference plane includes projections extending away from a direction of said immediate proximity of said first group of lead fingers and said second group of lead fingers, respectively.

B' 11. The assembly of claim 10, further comprising a packaging material extending over at least one of said first voltage reference plane and said second voltage reference plane, wherein said projections extend through said packaging material.

12. The assembly of claim 11, wherein said projections extend through said packaging material to an exterior surface thereof.

13. (Previously Amended) The assembly of claim 1, wherein said first voltage reference plane and said second voltage reference plane are of sufficient mass to measurably alter heat transfer characteristics of said assembly.

14. The assembly of claim 1, further comprising a packaging material encapsulating said assembly so that only outer ends of said at least said first group of lead fingers and said second group of lead fingers extend therethrough.

15. (Previously Amended) The assembly of claim 1, wherein said first voltage reference plane and said second voltage reference plane extend over at least about fifty percent of a surface area of said at least said first group of lead fingers and said second group of lead fingers, respectively.

16. (Previously Amended) The assembly of claim 1, wherein said first voltage reference plane and said second voltage reference are separated from said at least said first group of lead fingers and said second group of lead fingers, respectively, by an insulating adhesive structure.

B' 17. (Previously Amended) The assembly of claim 16, wherein said insulating adhesive structure comprises an insulating film having an adhesive on opposing surfaces thereof, one surface of said opposing surfaces being adhered to at least one of said first group of lead fingers and said second group of lead fingers and another surface of said opposing surfaces being adhered to at least one of said first voltage reference plane and said second voltage reference plane.

18. (Twice Amended) A vertical surface mount lead frame to be assembled to a semiconductor die, comprising:
a lead frame having at least a first group of lead fingers and a second group of lead fingers to respectively extend from first and second opposing sides of an intended die-attach location to another, single side of said lead frame in a substantially mutually parallel configuration;
a first voltage reference plane to overlie in immediate proximity said first group of lead fingers and in electrical isolation therefrom, said first voltage reference plane overlying at least a turning portion of said first group of lead fingers extending from said first side of said intended die-attach location toward said another, single side of said lead frame; and
a second voltage reference plane to overlie in immediate proximity said second group of lead fingers and in electrical isolation therefrom, said second voltage reference plane overlying at least a turning portion of said second group of lead fingers extending from said second opposing side of said intended die-attach location toward said another, single side of said lead frame.

19. (Previously Amended) The assembly of claim 18, wherein said first voltage reference plane and said second voltage reference plane are adhered to at least some of the lead fingers of said first group of lead fingers and said second group of lead fingers, respectively.

B' 20. (Previously Amended) The assembly of claim 19, wherein said first voltage reference plane and said second voltage reference plane are adhered directly via a non-conductive adhesive to said at least some of the lead fingers of said first group of lead fingers and said second group of lead fingers, respectively.

21. The assembly of claim 18, wherein said lead frame includes a die-attach paddle to which said semiconductor die is attached.

22. The assembly of claim 18, wherein said die-attach location comprises a die-attach paddle.

23. The assembly of claim 18, wherein at least one of said first voltage reference plane and said second voltage reference plane includes projections extending away from a direction of said immediate proximity of said first group of lead fingers and said second group of lead fingers, respectively.

24. (Previously Amended) The assembly of claim 18, wherein said first voltage reference plane and said second voltage reference plane extend over at least about fifty percent of a surface area of said at least said first group of lead fingers and said second group of lead fingers, respectively.

B' 25. The assembly of claim 18, wherein said first voltage reference plane and said second voltage reference is separated from said at least said first group of lead fingers and said second group of lead fingers, respectively, by an insulating adhesive structure.

26. (Previously Amended) The assembly of claim 25, wherein said insulating adhesive structure comprises an insulating film having an adhesive on opposing surfaces thereof, one surface of said opposing surfaces being adhered to at least one of said first group of lead fingers and said second group of lead fingers and another surface of said opposing surfaces being adhered to at least one of said first voltage reference plane and said second voltage reference plane.

REMARKS

The Office Action mailed December 14, 2001, has been received and reviewed. Claims 1 through 26 are currently pending in the application. Claims 1 through 26 stand rejected. Applicants have amended claims 1 and 18, and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 102(b) Anticipation Rejections

Anticipation Rejection Based on U.S. Patent No. 5,089,878 to Lee

Claims 1, 3 through 10, and 13 through 17 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Lee (U.S. Patent No. 5,089,878). Applicants respectfully traverse this rejection, as hereinafter set forth.

Turning first to amended independent claim 1, it recites as follows:

- a lead frame having at least a first group of lead fingers and a second group of lead fingers to respectively extend from first and second opposing sides of said semiconductor die attached to a die-attach location on said lead frame to another, single side of said lead frame in a substantially mutually parallel configuration;
- a first voltage reference plane to overlie in immediate proximity to said first group of lead fingers and in electrical isolation therefrom, said first voltage reference plane overlying at least a turning portion of said first group of lead fingers extending from said first side of said intended die-attach location toward said another, single side of said lead frame; and
- a second voltage reference plane to overlie in immediate proximity to said second group of lead fingers and in electrical isolation therefrom, said second voltage reference plane overlying at least a turning portion of said second group of lead fingers extending from said second opposing side of said intended die-attach location toward said another, single side of said lead frame.

Turning to the Lee Reference, there is disclosed a lead frame assembly including a lead frame 8 with lead fingers extending from a die attach paddle 10. An integrated circuit chip 2 is attached to the die attach paddle 10 and electrically connected to the lead fingers through wire

bonds. Disposed over each of the lead fingers 12 are trapezoidal coupons 18 or copper plates to provide low impedance to the lead fingers 12. See Lee, column 3, lines 12-51; and FIGS. 1(a), 1(b) and 1(c).

However, in the Lee reference, the lead fingers 12 do not extend from opposing sides of the die attach paddle 10 and then extend to another, single side of the lead frame. Rather, the lead fingers extend from each side of the die attach paddle 10 to a respective corresponding side of the lead frame 8. Furthermore, the coupons 18 in the Lee reference are not disposed over lead fingers that extend from opposing sides of the die attach paddle 10 to another, single side of the lead frame 8, but rather, each coupon 18 is disposed over a group of lead fingers that extend from one side of the die attach paddle 10 to a corresponding same side of the lead frame 8.

As noted by the Court of Appeals for the Federal Circuit in *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (1987), "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Applicants respectfully submit that claim 1 requires the presence of both a first and second voltage reference plane disposed over a turning portion of the lead fingers which extends from respective first and second opposing sides of an intended die-attach location toward another, single side of the lead frame. Since the Lee reference does not teach or disclose such a limitation, the rejection of independent claim 1 under 35 U.S.C. 102 over the Lee reference should be withdrawn.

With respect to dependent claims 3-10, and 13-17, they should each be patentable over the Lee reference based on their respective dependencies from independent claim 1. Thus, Applicants respectfully submit that the rejection of claims 3-10 and 13-17 be withdrawn.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,089,878 to Lee and Further in Combination with U.S. Patent No. 5,113,200 to Bozzini

Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee (U.S. Patent No. 5,089,878), as applied to claim 1, and further in combination with Bozzini (U.S. Patent No. 5,113,200). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

As noted, the Examiner bases this rejection on the Lee reference as applied to claim 1. However, independent claim 1 has been amended to recite that both the first and second voltage reference plane is disposed over a turning portion of the lead fingers which extends from respective first and second opposing sides of an intended die-attach location toward another, single side of the lead frame. The Lee reference does not teach or suggest such a limitation.

With respect to the Bozzini reference, it was relied upon for teaching the vertical surface mount package configuration recited in dependent claim 2. However, the Bozzini reference also does not teach or suggest the deficiency of claim 1, specifically, a first and second voltage reference plane and, further, a first and second voltage reference plane disposed over respective turning portions of a first and second group of lead fingers as recited in independent claim 1. Therefore, since the Lee reference and the Bozzini reference do not teach or suggest that which is recited in amended independent claim 1, dependent claim 2 should at least be patentable based

on its dependency from independent claim 1. Thus, Applicants respectfully submit that the rejection of claim 2 should be withdrawn.

Obviousness Rejection Based on U.S. Patent No. 5,089,878 to Lee and Further in Combination with U.S. Patent No. 5,583,377 to Higgins

Claims 11 and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee (U.S. Patent No. 5,089,878), as applied to claims 1, 3 through 10, and 13 through 17, and further in combination with Higgins (U.S. Patent No. 5,583,377). Applicants respectfully traverse this rejection, as hereinafter set forth.

The Examiner bases the rejection of claims 11 and 12 on the Lee reference as applied to claims 1, 3 through 10, and 13 through 17. However, independent claim 1 has been amended to recite that both the first and second voltage reference plane is disposed over a turning portion of the lead fingers which extends from respective first and second opposing sides of an intended die-attach location toward another, single side of the lead frame. The Lee reference does not teach or suggest such a limitation.

With respect to the Higgins reference, it was relied upon for teaching projections extending through said packaging material in dependent claim 11 and for teaching projections extending to an exterior surface of the packaging material in claim 12. However, the Higgins reference also does not teach or suggest the deficiency of claim 1, specifically, a first and second group of lead fingers and, further, a first and second voltage reference plane disposed over respective turning portions of a first and second group of lead fingers as recited in independent claim 1. Therefore, since the Lee reference and the Higgins reference do not teach or suggest that which is recited in amended independent claim 1, dependent claims 11 and 12 should at least be patentable based on their dependency from independent claim 1. Thus, Applicants respectfully submit that the rejection of claims 11 and 12 should be withdrawn.

Obviousness Rejection Based on U.S. Patent No. 5,089,878 to Lee and U.S. Patent No. 5,113,200 to Bozzini

Claims 18 through 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Lee (U.S. Patent No. 5,089,878) and Bozzini (U.S. Patent No. 5,113,200). Applicants respectfully traverse this rejection, as hereinafter set forth.

In the rejection, the Examiner acknowledges that the Bozzini reference is deficient by stating the following:

However, Bozzini does not appear to explicitly teach a first reference plane to overlie in immediate proximity said first group of lead fingers and in electrical isolation therefrom; and a second voltage reference plane to overlie in immediate proximity said second group of lead fingers and in electrical isolation therefrom. (Office Action, page 9, lines 1-6).

The Examiner then relies on the Lee reference for teaching the above noted deficiency, stating that it would have been obvious to combine the product of Lee with the product of Bozzini because it would reduce impedance.

Applicants respectfully disagree with the Examiner's rejection for at least two reasons: First, a person of ordinary skill in the art would not have been motivated to combine the references for the reasons the Examiner suggests; and, second, the combined references do not teach or suggest that which is recited in amended claim 18.

Turning to the first issue, a person of ordinary skill in the art would not have been motivated to combine the references for the reasons the Examiner suggests. Specifically, the Examiner states that such combination would have been obvious because it would reduce impedance. However, there is nothing in the Bozzini reference that teaches or suggests impedance and/or problems relating to impedance therein. Further, there is nothing that teaches or suggests voltage reference planes or the necessity of providing such voltage reference planes in the Bozzini reference. Rather, the Bozzini reference is directed to a monolithically formed lead frame structure that provides heat dissipation from a depressed portion 15 on which an

integrated circuit may sit, wherein a bottom surface of the depressed portion is exposed through the packaged lead frame for heat dissipation. *See* Bozzini, column 3, lines 6-62; FIGS. 2-4.

Furthermore, the Lee reference does not teach or suggest a vertical surface mount lead frame configuration. Moreover, the Lee reference does not teach or suggest utilizing a voltage reference plane arrangement that would be workable on a vertical surface mount leadframe. Rather, the Lee reference teaches trapezoidal coupons 18a 18b that completely surround a chip 2 (*See* FIGS. 1(a), 1(b), and 1(c)). Thus, based on the foregoing reasons, a person of ordinary skill in the art would not have been motivated to combine the references for the reasons the Examiner suggests.

Tuning to the second issue, even if a person of ordinary skill in the art did combine the references, the combined references do not result in the claimed subject matter. Rather, additional modifications would be required if the Lee reference and the Bozzini reference were combined. In particular, independent claim 18 has been amended to recite as follows:

- a first voltage reference plane to overlie in immediate proximity said first group of lead fingers and in electrical isolation therefrom, said first voltage reference plane overlying at least a turning portion of said first group of lead fingers extending from said first side of said intended die-attach location toward said another, single side of said lead frame; and
- a second voltage reference plane to overlie in immediate proximity said second group of lead fingers and in electrical isolation therefrom, said second voltage reference plane overlying at least a turning portion of said second group of lead fingers extending from said second opposing side of said intended die-attach location toward said another, single side of said lead frame.

Independent claim 18 requires that the respective first and second voltage reference planes overlie at least a turning portion that extends from the respective first and second opposing sides of an intended die attach location to another, single side of the lead frame.

In contradistinction to amended claim 18, the Lee reference discloses coupons 18a and 18b overlying lead fingers that extend from each of first, second, third and fourth sides of a chip to corresponding respective first, second, third and fourth sides of a lead frame. Thus, the Lee

reference does not disclose coupons 18a and 18b which overly a turning portion of the lead fingers which extend from a first and second opposing sides of an intended die attach location to toward another, single side of the lead frame.

Furthermore, if the coupon arrangement disclosed in the Lee reference were provided over the lead fingers in the Bozzini reference, the coupons would not fit over the lead fingers in a manner conducive to the single-side lead frame configuration. Rather, the coupons would be situated symmetrically around the depressed portion, which would result in some of the coupons not being disposed over the lead fingers due to the type of single-side lead finger configuration disclosed in the Bozzini reference. Such a result would require additional modifications and would essentially result in the product disclosed in the Bozzini reference to be unsatisfactory for its intended purpose. Thus, since additional modifications would be required if the references were combined, the combined references do not teach or suggest that which is recited in amended claim 18.

With respect to dependent claims 19-26, they are patentable over the Lee reference and Bozzini reference based on at least their respective dependencies from independent claim 18.

ENTRY OF AMENDMENTS

The amendments to claims 1 and 18 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

CONCLUSION

Claims 1 through 26 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully Submitted,



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